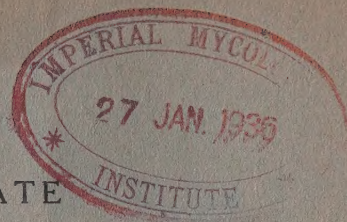


ZANZIBAR PROTECTORATE



ANNUAL REPORT
OF THE
DEPARTMENT OF AGRICULTURE
1934

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1935

DEPARTMENT OF AGRICULTURE.

ANNUAL REPORT, 1934.

STAFF.

Rank.	Name.	Period in Residence.
Director	... A. J. FINDLAY, M.A. B.Sc., Agric. (Aber.), N.D.A., N.D.D.	January 1st to June 6th.
Assistant Director	... Harold Waterland, Dip. Agric. (Harper Adams).	January 1st to December 31st.
Government Chemist	... L. W. Raymond, B.A., B.Sc., Hons. (London), A.R.C.S., A.I.C.	January 1st to December 31st.
Manager of Plantations	... I. G. C. Squire.	January 1st to August 9th.
	J. E. Baker, Cert. Agric. (Seale Hayne).	January 1st to December 31st.
	J. R. P. Soper, B.A. (Cantab.).	July 1st to December 31st.
Agricultural Officers	... { R. Johns, N.D.A., C.D.A., (Aberystwyth), A.I.C.T.A. (Trinidad).	January 1st to March 13th and September 24th to De- cember 31st.
	F. B. Wilson, B.A. (Cantab.) Dip. Agric. (Cantab.) A.I.C.T.A. (Trinidad).	January 1st to December 31st.
Inspector of Produce	... R. W. Donkin, Dip. Agric. (Wye).	June 2nd to December 31st.
Silviculturist	... L. G. T. Wigg, B.A., Forestry, (Oxon), Dip. Forestry (Oxon), B.A., Hons. Botany (Oxon).	January 25th to December 31st.

CORRIGENDUM

Page 5, under heading "Financial", para 2, line 1.

Read £583,725 for £58,372—10s.

but unfortunately sporadic. In Pemba the distribution was not so regular. The *masika* or main rains were plentiful, but were followed by a comparatively dry spell, which lasted until the end of November. Thus the *vuli* or late rains were below average. Weather conditions on the whole were favourable to crop production.

The Clove Industry.—In reporting on the 1933 clove crop, it was remarked that the drought in 1933 did not affect the bulk of the crop in that year, but caused the late or *vuli* crop to persist well into 1934, while the possible effect on the 1934 crop was a matter of conjecture. As the year 1934 advanced the effect became evident in the postponement of the first flowering period. About the month of March when the first evidence of the main crop is generally visible, there was a very small and irregular flush of new flower buds, indicating that the main crop was likely to be below average. After a heavy crop for the 1933-34 season it was anticipated that the 1934-35 crop would be a medium one of about 600,000 frasilas,* but that anticipation was based on the generally accepted idea, founded on experience, that a medium crop would follow a heavy one, which had been preceded by a light crop as was the case in the 1932-33 season. The possible effects of the 1933 drought, being unknown, could not be taken into calculation,

*1 frasila=35 lbs.

and it was not until later in the year that it became evident that preconceived ideas of crop production were going to be upset by the abnormality in weather conditions in 1933. In June, 1934, there appeared a sudden flush of buds which showed that the usual crop position was going to be reversed in that the late or *vuli* crop would be heavier than the main or *mwaka* crop. In the majority of plantations the flush that appeared in June was exactly like what is ordinarily expected about March when the first flush for the main crop appears. The final result was that the 1934-35 season produced a heavy crop which according to market delivery figures is recorded at 864,166 frasilas. This production position of two heavy crops in succession is unique in the history of the Zanzibar clove industry, and shows the unreliability of pre-estimations based on a supposition that there is anything like a definite cycle in clove production. Conditions which obtained in 1934 also illustrate the difficulty of making crop forecasts in regard to the clove crop, and indicate the caution which must be observed in accepting any forecasts—mere approximations at the best—which are not based on very close observations of actual flower bud appearance over a period of the year sufficiently long to include both main and late crop flushes. On account of the unusual nature of the 1934-35 crop, the progress of harvesting operations throughout the season is of particular interest. In Zanzibar Island, we may take harvesting operations on the Government Plantations as typical of those prevailing throughout the clove areas. The picking of the main crop commenced in June and increased to August and September, yet the total picking from June to September, representing the main crop, did not reach the amount picked in October, which again was more than doubled in November, the peak month of the late crop. This was followed by a decrease in December to about two-thirds, and then an increase in January 1935. There was a sudden drop in February when the harvest practically finished. Detailed figures are given under the heading—Government Plantations: Cloves.

Practically the same conditions prevailed in Pemba as is shown by the figures for supplies delivered to the Zanzibar market. These supplies rose from 19,435 frasilas in July to 49,653 in September, 90,755 in October, and reached their peak at 106,473 frasilas in November. December showed a drop to 55,527 frasilas and January 1935 to 43,440 frasilas.

The Pemba crop, calculated on market supplies figures at 503,412.5 frasilas was comparatively small with the Zanzibar crop at 360,753.5. This was most unusual as the proportion for Pemba to Zanzibar is more often about two to one.

Attention was drawn in the 1933 report to the influx of 13,000 clove pickers to Pemba to deal with a big crop which finally was calculated at 789,332 frasilas as delivered to the Zanzibar market. During the 1934-35 clove season, when the market deliveries from Pemba totalled 503,412 frasilas, no picking labour is recorded as having been imported from Zanzibar, which shows that there evidently is labour available in Pemba for picking quite a big crop without assistance from Zanzibar. Granted that the 1934-35 crop in Pemba was a late one and extended over a longer period than usual, the indication that the local Pemba labour is being more fully employed in the local industry is definitely satisfactory.

Picking rates varied as usual throughout the season; in Zanzibar the rate started at 4 pice per *pishi* and advanced to 5 pice when the heavy crop matured from October onwards. In some parts the rate had to be raised to 6 pice at the end of November. In Pemba picking rates started at 4 pice and went up to 7 pice at the height of the harvest.

There are no reliable records for general tree yields for the 1934-35 crop in Pemba, but in Zanzibar the figure for the average tree yield—8.78 lbs. of dry cloves per tree,—may be taken as correctly representing a heavy crop. The corresponding figure for 1933 was 3.247 lbs. per tree. The general quality of cloves produced was good in spite of the fact that drying conditions from October to December were not favourable in many places. The operation of the Adulteration of Produce Decree was thoroughly effective in preventing improperly dried cloves being sent to the Zanzibar market. The Decree, together with the Clove Grading and Export Rules, made under the Agricultural Produce Export Decree, has done a very great deal to establish a standard of quality

in Zanzibar cloves which had never been previously attained. The stabilization of prices, due to the beneficent operations of the Clove Growers' Association, for a product of definitely improved and now standardized quality bids fair to place the clove industry of Zanzibar on a sound and prosperous basis.

The activities of the Department of Agriculture which are being devoted to such important items as the production of selected and improved planting material, improved methods of planting and cultivation, regeneration, nutrition, pests and diseases, are being co-ordinated with the regulation of the finished product to stabilize the clove industry on a basis which is sound economically for all participants, from the growers of the clove tree to the consumers of the manufactured products.

The general decline in clove prices which was noted in 1932 continued until the end of 1933, when prices had reached a low level unequalled since the period 1900-1903. The beginning of 1934 saw a slight rise which however was not maintained and in May the duty paid price of the cloves had dropped to Rs. 7.81 cents per frasila. However there was a sustained improvements for the rest of the year attaining to a maximum average of Rs. 10.40 cents in August. Stem prices were definitely lower in 1934 at Rs. 1.40 cents than in 1933 at Rs. 1.75 cents per frasila, F.O.B. Table II in the appendix gives comparative details of prices of cloves and clove stems in 1933 and 1934.

Clove exports for the calendar year were 696,045 frasilas as compared with 689,039 frasilas for 1933 and 518,600 for 1932. The export of stems increased from 171,540 frasilas in 1933 to 232,393 in 1934. Tables III and IV give comparative details of exports and destinations.

The Coconut and Copra Industry.—Nut production on the Government Plantations may be taken as a criterion indicating that general production was good. The average production per tree worked out at 40.80 nuts per palm from 65,021 bearing palms as compared with 39.28 and 31.96 nuts per palm for 1933 and 1932 respectively. The total export of copra for the year was 270,061 cwts., from which 21,710 cwts. must be deducted as representing mainland copra re-exported. Thus the domestic export amounts to 252,141 cwts., an increase of 7,266 cwts. over that for 1933. There was a definite decline in re-exported copra, due to the fact that mainland copra was being exported direct to European markets instead of being imported to Zanzibar for mixing with the local product. The following figures indicate the trend of copra production and exports:—

Year.	Total Exports Cwts.	Re-Exports Cwts.	Domestic Exports Cwts.	Values (Domestic Export) Rs.
1930	354,000	90,000	256,000	32,13,000
1931	337,000	102,000	235,000	19,96,000
1932	333,000	97,000	236,000	19,13,000
1933	336,000	91,000	245,000	14,03,000
1934	274,000	22,000	252,000	9,53,000

The export figures do not by any means represent the actual production as about 15,000 cwts. are absorbed by the local crushing mills for oil production, there was an export of 932,898 whole nuts, equal to 3,100 cwts. of copra; and there is a very large but indefinite consumption of nuts for food purposes, estimated as high as one nut per head of population per day on a population of 235,000.

Owing to the continued inferior quality of Zanzibar copra the available markets for this class of produce are only Marseilles and Genoa which took 29,492 cwts. and 215,301 respectively. This represents an increase of 58,729 cwts. for Genoa and a decrease of 56,945 cwts. for Marseilles as compared with 1933 exports. There was an export of 5,527 cwts. to Great Britain in 1934 and none in 1933.

Comparing values in relation to domestic exports in the table given above, it will be seen that 1934 was a very poor year for copra prices which averaged only .98 cents of a rupee per frasila, varying during the year from .85 cents in April to Rs. 1.19 cents in October; see Table V. It was only by reducing

production costs that a very doubtful margin of profit was maintained; in fact it is to be feared that copra production was often carried on at a loss.

The price of whole nuts fell in sympathy with copra prices and ranged from Rs. 6 to Rs. 11 per 1,000. There was an export of whole nuts amounting to 932,898—valued at Rs. 17,810; as compared with 925,161 nuts valued at Rs. 24,365 for 1933. In 1932, a year of a reasonable copra prices, 876,000 nuts exported were valued at Rs. 29,000.

It is a matter for great regret that the quality of Zanzibar copra showed no improvement during the year. With heavily depreciated prices there was no incentive to improvement; in fact the reverse was the case, for knowing that the margin of profit on copra had diminished to practically vanishing point, the producer expended the minimum of time and labour in copra preparation with the idea of realizing on his produce with the minimum of delay. Local producers, whether Arab, Indian or African, will not appreciate that an improvement in quality at a time of depressed prices will make all the difference between profit and loss owing to the better quality commanding a premium. They will not realize that "quality tells". Probably the greatest obstacle to the improvement in quality of Zanzibar copra is the persistent use of immature nuts. The recognized practice of cutting nuts from the trees is mainly responsible for this, and it will be difficult to alter this practice because of the prevalence of predial larceny, for there is a local idea that fallen nuts are more or less common property. In an endeavour to avoid loss on that account, the *shamba* owner "falls" his nuts and collects them immediately. Unfortunately the climbers exercise no care in the selection of the nuts which they cut, so that the final gathering is a mass of nuts in all stages of immaturity and maturity. Climbers, being specialists and scarce, dictate their own terms. The presence of a proportion, generally a large one, of immature nuts would be counteracted to a certain extent if the nuts were allowed to mature in a heap for a period that might extend even to two months, but local producers are not prepared to store their nuts "in heap", because they wish to realize on them immediately, so they either break them for copra making or dispose of them as whole nuts immediately. If the latter, then the purchaser of the nuts, usually a shopkeeper, Manga Arab or Indian, is equally anxious for an immediate return and breaks the nuts to make copra without delay. The resulting product would not be so inferior as it is if only the copra maker would exercise care, but he has no thought except for the prospect of immediate profit and piles his broken nuts above a coconut husk smoke fire in order to drive off excess of moisture and give the copra what he hopes will be a preservative coat of creosote. This half dried smoked product is bagged and sent to Zanzibar Town, perhaps after a period of bad storage, where it is purchased by merchants who bulk it, often in unsuitable stores. Such inferior copra in bulk deteriorates rapidly and the final product is nothing more or less than a rotting mass of good original material ruined by preparation. The worst copra comes from Pemba, where the use of immature nuts seems to be the rule rather than the exception, and where the local Indian shopkeeper treats his copra like so much dirt.

The system of harvesting coconuts which is universally followed in Zanzibar on plantations of any size is to climb the palms and cut down the nuts four times a year. With the object of ensuring that only mature nuts are used in copra making, this system has been abandoned on the Experimental Station at Kizimbani in favour of a system of collecting only fallen nuts. Experience already obtained (described under Kizimbani Experimental Station—Estate Work—Coconuts) has shown that this system has a great deal to recommend it for general adoption.

The introduction of the Adulteration of Produce Decree in 1934 aimed at an improvement in both cloves and copra, but unfortunately it was only possible to enforce the provisions of the Decree as regards cloves; the application to copra had to be postponed until 1935, when without doubt the operation of the Decree will effect a marked improvement, which it is intended to follow up by the introduction of a scheme for inspection and grading for export.

Other Export Crops.—*Fruit.*—There is no organized export industry in respect of fruit and supplies are sent mostly to neighbouring territories on the

East Coast of Africa. Customs figures show that 7,346 cwts. valued at Rs. 25,025 were exported during 1934, including 743 cwts. as supplies for ships' use. A large proportion of the exports, probably 4,900 cwts. consisted of Zanzibar oranges, which bear a good reputation but are neither graded nor properly packed for export. Various markets, including Europe, have been tested and proposals for a grading and packing scheme have been made.

Tobacco.—In certain selected areas in the Protectorate, there is a considerable amount of successful tobacco cultivation. Local requirements for native tobacco are satisfied and the surplus is exported in the form of rolled plaits; 18,375 lbs. went to Italian Somaliland and 900 lbs. to Arabia in 1934.

Food Crops.—The cultivation of native food crops has never received the attention that it deserved, mainly because the former prosperity of the clove and copra industries provided the people with the means of purchasing imported food stuffs. Now that the days of high export prices have gone, the rural population is devoting more time to the production of the recognized local food crops. This is most noticeable in the case of Rice; in Pemba an unusually large area was put down to this crop—both swamp and hill—and after a favourable growing season, yields proved to be above average. Similar conditions obtained in Zanzibar but heavy *masika* rains damaged many of the crops. Rice cultivation in Pemba is a very important item in native cultivation: cultivation methods are being studied and pure strains are being selected with a view to improvement, and an endeavour to make the island as near self supporting in rice supplies as possible. Zanzibar Island could produce sufficient rice for its rural population, but supplies for the large urban population in Zanzibar Town will always have to be imported.

The other crop of major importance is cassava which is grown extensively throughout the Protectorate. Unfortunately *mosaic* is very prevalent and steps are being taken to isolate resistant varieties from local stock and try out imported varieties. Yield trials are also under investigation.

The year 1934 was favourable for the production of food crops and supplies were plentiful and cheap. There are two main types of native cultivation, one in the clove areas and the other in the *wanda* or coral rag country. In both cases the methods of cultivation leave much to be desired; there are particularly no recognized rotations and no system for the conservation of soil fertility. All aspects of native food production are under investigation at the Experiment Stations.

FINANCIAL.

A brief study of the financial position of agriculture in the Protectorate and the relation of the Department of Agriculture, reveals some interesting figures.

The value of agricultural exports in 1934 was Rs. 77,83,000 (= £58,372 - 10s. at Re. 1 = 1/6d.) made up as follows in order of importance:—

	Rs.
Cloves	... 6,369,000
Copra	... 1,036,000
Clove Stems	... 324,000
Fruit	... 25,000
Coconuts	... 18,000
Coconut Oil	... 6,000
Tobacco	... 5,000
Total	Rs. 7,783,000

Revenue derived from export duties amounted to Rs. 1,434,411 representing 23.9% of a gross Protectorate revenue of Rs. 6,002,649. The revenue of the Department of Agriculture amounted to Rs. 185,088, which is 3.1% of the Protectorate revenue.

The expenditure of the Department amounted to Rs. 368,179 or 6.26% of the total Protectorate expenditure. If the Department's revenue of Rs. 185,088 is deducted, the net expenditure is only 3.14% of the Protectorate

expenditure. Taken in relation to the export value of agricultural products, the Department's expenditure is 4.73% of that value.

To summarize, agriculture in the Protectorate in 1934 provided a direct revenue of Rs. 1,434,411 for a net expenditure of Rs. 183,091 on the Department of Agriculture.

DEPARTMENTAL BRANCHES.

Detailed reports of the activities of the separate branches of the Department have been submitted by the Officers-in-Charge. As these reports are not being printed, they are summarized as follows for general information.

KIZIMBANI EXPERIMENT STATION, ZANZIBAR.

Continuation of Development Work.—The year under review constitutes the second full working year of the Kizimbani Experiment Station which was first opened in May, 1932. In a large estate such as Kizimbani the work of development is naturally protracted so that even yet development work is proceeding in the organization of the experimental and investigational programme which included further provision for annual crop experiments, the lay out of an area for spices and essential oil yielding plants, extensions of the nurseries, orchard, arboretum, and clove experiment blocks.

Estate Management and Experimental Work.—As the Kizimbani estate which comprises a compact group of former Government Plantations, has a total area of approximately 3,500 acres, the work of estate management is considerable and has to be carried out in conjunction with experimental and investigational work. On account of concentration of staff and funds on the latter aspect of the work, the condition of the estate has not been maintained up to the standard of good estate management, but it is anticipated that in 1935, a decrease in development work will allow of more attention being paid to the institution of good farming practices which can be demonstrated to local agriculturists. Local interest in the activities of the Station has shown a very welcome increase as is evident from the visits of numerous local agriculturists who have shown a keen and appreciative interest in improved methods and practices, and requested advisory visits to their own plantations. The connexion which we are thus establishing with the rural population should form an excellent basis for the extension work which is being organized as an essential feature of the activities of the Department.

Climatic Conditions.—After the drought of 1933, conditions returned to normal in 1934 when there was a plentiful and well distributed rainfall which was favourable to plant growth. The total rainfall was 77.03 inches which fell on 169 days. The *masika* or main rains set in at the normal time in March, with the change of the monsoon, and continued until early June, with the heaviest precipitations in April and May. Light rains at the middle of the year were followed by plentiful *mvuli* or late rains from October to December. The distribution was good, for there was not a month without some rain. Detailed records are given in Table VI A.

Staff.—The normal establishment of the Station consists of two Agricultural Officers, augmented by a Silviculturist, seconded from Tanganyika, to undertake clove investigational work. Owing to the absence of an Agricultural Officer on a study tour in the Far East the establishment was below strength for part of the year.

The subordinate staff consisted of one Asiatic Superintendent, one Head Overseer, and three Assistant Overseers, supplemented by four Arab and African pupils in training. The lack of a properly trained subordinate staff continues to be a limiting factor in the progress of the work of the Station, although with the assistance of the Head Overseer, who fortunately has had a technical training, the Agricultural Officers have succeeded in enhancing the value of the available staff for experimental and investigational work. Previously there had never been opportunities or facilities for technical training in Agriculture in Zanzibar and it was only to be expected that it would take a considerable amount of time and trouble to mould the raw material available. The original selection

of pupils-in-training, which was haphazard in the extreme, has now been worked off and weeded out, and the time has arrived for the careful selection of agricultural pupils who will be put under an organized scheme of training.

ESTATE WORK.

General.—The main road system of the Station was maintained at a cost of Rs. 542.18 for 4.38 miles and an old track to Kidichi providing access to the Rest House and to the Rural School was reconstructed at a cost of Rs. 222.69 for .83 mile. A new plant and potting shed was constructed and other estate buildings repaired or renovated; a concrete lined well 25 feet deep was sunk to provide a water supply for the stock and poultry section and orchard.

Labour.—The supply of unskilled labour was good, except during the clove harvest. The source of supply is still the mainland, which is unfortunate because of the lack of permanence in the labour staff. It is disappointing also to have to lose always the services of those who have been trained and become skilled, because of their disinclination to settle permanently in Zanzibar. It is hoped that economic conditions will force the families of the too numerous squatters to enter the labour market. This might form the nucleus of a future skilled labour supply. The squatters themselves show no inclination to work as estate labourers but are content to pick cloves during the harvest and make out a living from land to which they have no rights. The rate of pay for unskilled labour was 7 annas a day, and for skilled 8 to 12 annas.

Cloves.—The general condition of mature trees was good, but there was considerable mortality amongst old and apparently healthy trees due to "Sudden Death", a peculiar disease which so far has defied identification, but is under investigation. A peculiarity of this disease is that it is confined to mature trees; so far attempts to infect seedlings and saplings have been unsuccessful.

Part of the *vuli* or late crop of 1933 was harvested in January and February 1934, and the 1934 main crop began to ripen in June. This was a very small crop which was followed by a heavy *vuli* or late crop the harvesting of which was begun in October and was still in progress at the end of the year. There were thus parts of three clove crops harvested within twelve months. The year's yield of cloves from the estate was 822 frasilas (of 35 lbs.). Picking prices varied from 3 to 5 pice per pishi (4 lbs.).

Coconuts.—Yields from estate coconut palms were well maintained and amounted to 11,43,818 nuts for the year as compared with 12,92,613 and 10,69,551 for 1933 and 1932 respectively. This was derived from a total population of about 40,000 palms in various stages of maturity.

The system of harvesting nuts was re-organized in June. Formerly the method adopted was that universally followed in Zanzibar, to climb the palms and cut down the nuts four times a year. This meant the harvesting of a high proportion of immature nuts with consequent deterioration in quality and loss in weight in the prepared copra. Under the new system only the fallen nuts are collected which ensures that all sound nuts are fully mature. Collecting gangs are so organized that they visit the demarcated areas monthly to collect the fallen nuts and transport them to the drying centres.

It has been argued that this system encourages predial larceny, which is unfortunately too common in Zanzibar, mainly because there is a prevalent idea that fallen nuts are more or less common property. Experience at Kizimbani does not seem to show that extensive losses are suffered owing to predial larceny, as during 1934 the number of nuts gathered compared favourably with numbers in previous years when the system of climbing and "falling" was in vogue. The following are the figures:—

Year.	Number of Nuts Gathered.
1931	... 10,85,976
1932	... 10,69,551
1933	... 12,92,613
1934	... 11,43,818

Systematic gathering obviates the possibility of large scale theft. The advantages of this system are: (a) climbing charges are eliminated and production costs reduced; (b) a regular supply of mature nuts is assured; (c) a

higher percentage of copra is obtained, and three is greater continuity in drying as nuts are available regularly all the year round. Mature nuts fall readily and germination does not occur on the palm as is recorded in some other coconut producing countries.

During the year 8,015 frasilas of copra were produced and sold at prices varying from Re. 1 to Rs. 1-13-6 per frasila; 4,30,135 whole nuts were sold at from Rs. 6 to Rs. 12 per 1,000 ex-heap. The copra was of uniformly good quality and was in demand for crushing in the local mills.

Other Estate Crops.—Land cleared for future planting was utilized immediately by planting up with such crops as cassava, maize, millet and mucuna. From this source many of the requirements of the live stock—bullocks and poultry—were supplied and surplus crops were available for sale. Fourteen acres of clove land alongside the main estate road were successfully put down to a mucuna cover crop which suppressed weed growth while it lasted but did not regenerate well. Mucuna following grain crops with the dry stalks to climb on gave excellent results. An area of three acres of clove land put down to Calapogonium bears a very dense lasting cover.

Miscellaneous.—The making of compost has now become a matter of estate routine. All waste organic material is collected in fenced heaps situated throughout the estate and treated by a simple method; the material is deposited in layers of about 6 inches, watered and covered with a little earth, wood ashes and cattle dung; to every ton of green material are added 50 lbs. lime, 30 lbs. superphosphate and 20 lbs. sulphate of ammonia. The heap is made up to a height of 3 feet and turned twice, first at the end of four weeks when one half of the heap is folded over on to the other; and then at the end of twelve weeks when a complete turn over is given. An excellent compost is obtained at the end of six months.

INVESTIGATIONAL WORK ON CLOVES.

General.—In order to study modern experimental and investigational methods on tree crops, Mr. Wigg, Silviculturist, and Mr. Johns, Agricultural Officer, visited the Research Stations at East Malling and Long Ashton while on leave in 1933. One conclusion drawn from this visit is the confirmation of the care necessary in complicated trials with tree crops to ensure final comparability of plots. This can only be achieved by the initial selection and recording of planting material and by a careful lay-out of the plots. Field experience here has shown that insufficient general knowledge of the behaviour of the clove plant under various conditions limits the number of trials that can be laid down on modern statistical lines at this time. Insufficient knowledge of the vagaries of the local climate has led to an error in thinking that nursery stock and field plants will react each season in the same way as they did in the first.

Demand for Clove Seedlings.—A balance of 10,000 plants suitable for field planting was carried forward from 1933 sowings. The total output of the nurseries was 40,000 clove seedlings of which 4,276 were sold at 1 anna each and the balance was reserved for the 1935 *masika* planting. The supply was not equal to the demand. Orders coming in before the end of the year indicated a very big demand for planting stock for 1935. Observations of the year have shown the superiority of the seedlings left in situ over all other treatments tried in 1933.

Seed Selection.—Seed from 62 marked trees in various localities was collected for a sowing amounting to 63,131 seed. The examination of 1,000 fresh clove fruits gave the following interesting results:—

- 1,000 fresh fruits weighed 3,060 grams.
- 456 Hulled seed of fresh olive colour weighed 430 grams.
- 232 Hulled seed of red or parti coloured weighed 92 grams.
- 36 Hulled seed were bored by caterpillar.
- 70 Hulled seed were too small or broken.
- 59 Hulled seed were multiple; usually paired in one fruit.
- 147 Hulled seed were broken and useless.

Thus the average weight of a good seed is nearly 1 gram, whereas a reddish or discoloured seed is less than half that weight. It is therefore calculated that about 6.7 kilograms or 2,200 fresh fruits are necessary to give 1,000 selected seeds weighing approximately 1 kilogram.

Details of Sowings.—The details of the sowings for 1935 planting are :—

Date Sown.	Seed Sown.	% Germination.
Nov.-Dec. 1933	23,196	95.8
January, 1934	7,638	73.0
January, 1934	32,297	82.0
	63,131	

The nursery stock census in November 1934 was :—

Seedlings in situ	... 31,278
Transplants	... 16,707
Miscellaneous	... 3,613
	51,598

This number is calculated to yield about 40,000 plants suitable for field planting. The sowing espacement was 6" between the lines and 3" in the lines; thinning was carried out to a staggered arrangement of 6" triangles, and thinnings were transplanted. Trials were made using hulled and unhulled seeds and germination and subsequent growth were found to be completely in favour of the former.

In November-December, 1934, the first sowing for 1936 planting was put down, 19,543 seeds at a wider espacement of 8" × 4". The thinnings from December 1933 and January 1934 sowings were transplanted to hardening-off beds at an espacement of 1' × 1' in April, 1934, when various types of sheds and screens were tried with the following results.

Shading of Nursery Beds for Transplants.—This was tried with a variety of materials the results being indicated below :—

Cassava.—An inexpensive and useful type of shade if virus-free stock is planted in single lines down each side of the bed.

Tephrosia Candida.—Provides useful general protection when planted as hedges for side shade, but apt to suppress the plants if too near (3 feet).

Albizia Moluccana.—Too unweildy.

Sorghum and Grass Screens.—Rot too quickly; shade too dense.

Slat Screens of Coconut Frond Midribs.—Set at least four to five feet high proved handiest and best; durable but rather heavy. Of the original 19,401 transplants, 16,707 were good plants in November.

Other Trials in Nursery Practice.—Were as summarized below :—

Direct Sowing in Bamboo Pots.—Germination of 100% was obtained but subsequent growth and survival was poor. The regulation of water supply in small pots proved difficult.

Transplants in Bamboo Pots.—Four series each of 200 plants having one pair, three pairs, five pairs and seven pairs of leaves respectively were set out in pots about 3" wide and 11" deep. Indications were in favour of the three and five pair classes, and survivals were greatest in the five pair class. The first season's equipment of leaves in the clove seedlings is normally three pairs.

Sowings under Cassava.—These were set out too late in the rains to be successful, but with more intensive initial care this might prove a cheap method of raising seedlings.

Transplants under Cassava.—The same remarks apply as in the sowings.

Potting Materials.—The leaf base of *Typhanodorum antiguorum* (Swahili—*Mgomba Kofi*) was tried for pot making but although more durable than the

banana fibre pot suffered from the same disability of not being strong enough to support the cylinder of soil under continued watering. If readily available in sufficient quantity, it should be useful material for tying up balled plants for transport. *Gigantochloa aspera* (from Amani) has been planted out for the production of material for large sized bamboo pots.

Lifting Plants for Distribution.—The clove seedling can be described as sensitive to root damage and must be treated with care in the transplanting process. Endeavours to establish seedlings freed of soil in pure sand cultures have demonstrated that after the root pruning which occurs when plants are lifted from the nursery beds with cylinders of earth, a period of nursing and regular watering under shade must be given to allow of recovery before planting out. Up to now no method has been devised whereby a naked rooted plant can be sent out for field planting. This is a problem of importance because the present method is costly on account of care in lifting, use of large quantities of wrapping materials and labour involved, provision of adequate shade and careful watering, wastage of soil from nursery beds and expense of transport from the nursery to the plantation. The cost of lifting these plants is about Rs. 20 per 1,000.

Plant Description.—Many nursery plants have been accurately measured, described, photographed and recorded for information in connexion with the initial conditions of plants used in various trials.

Uniformity Trial.—Following the recommendations of the Statistical Officer at East Malling Research Station, a uniformity trial has been laid down whereby variation between the progeny of four different parent trees is to be investigated, yield being the chief criterion. The first planting of two acres was laid down in 1934; it is proposed to repeat this in five successive years, using four new parents each year. In order to provide a large number of plants for individual examination, the original planting distance was made 14' × 14', which will be thinned to 28' × 28' as soon as root competition is suspected. Another object of the close planting is to try out Professor Troup's suggestion for a more economic use of the ground by close planting and subsequent thinning. The progeny of the parent trees are so arranged and replicated that both the position of thinnings and of the trees of the final stand are arranged in latin squares. *Tephrosia candida* is used as a nursing shade and green manure, set out in three rows between the clove lines, four feet apart from the cloves and three feet between the rows. There were only 10% casualties in the 1934 planting and these were due chiefly to termite damage. By the end of the year, some of the seedlings were over four feet high. Plants used were hardened-off seedlings 13 months old.

Shade Tree Progeny Trial.—Thirty six lines of seedlings, each line from a separate parent tree, have been set out 14 feet apart in lines 24 feet apart with *Tephrosia candida* side shade. Blocks of *Gliricidia maculata*, *Albizia moluccana* and *Cassia siamea* are used as overhead shade on the lower half of the progeny lines. The objects of the trial are to observe variations in growth and yield from different type of parents, to test the effects of shade, the suitability of the particular espacement (28 feet triangular after thinning) and the possibility of intermediate financial yield from the plants to be thinned out. Eventually all undesirable trees will be discarded and only superior trees left as seed bearers. Preparations for a further trial with 33 more parent trees were in hand at the end of the year.

Natural Regeneration Trial.—In a canopy-bound stand of old trees a trial has been laid down to test the possibility of regenerating from self-sown seedlings situated at the intersection of the diagonals of the existing square planting. The canopy will gradually be reduced to give the seedlings an opportunity for developing. The old trees are not unproductive, but harvesting is costly—sometimes uneconomic—and difficult owing to the crop being borne only on the top branches. If a new stand can thus be established, it would bridge an unproductive period of the first five years in the life of the intermediate saplings. The present indications are that the intermediate natural seedlings will develop into tall leggy and unsatisfactory trees.

Regeneration of Clear-Felled Area Using Field Crop Shade.—An area of five acres in which “Sudden Death” had accounted for most of the old trees was clearfelled and ridged (five feet ridges) for planting Cassava to serve as a catch crop and as shade for seedlings, to be planted in alternate lines at 15' × 30'. The whole area is to be planted with the progeny of one parent tree. The Cassava will also serve as a cleaning crop in an area over-run with *Imperata* grass.

Individual Tree Records.—Three blocks of bearing cloves with 600, 300, and 200 trees positions respectively have been examined and recorded through the following harvests: Main crop *mwaka* 1933, late crop *vuli* 1933-34, main crop 1934 and part of late crop 1934-35. The accurate harvesting of these trees has not yet been finally worked out as it entails further consideration of such details as to what crop should be offering before harvesters are put to a tree, and involves estimates to reduce a carefully, but possibly uneconomically, picked stand to figures comparable to what an estate owner would get who presumably must allow some branch breaking and would not consider putting pickers in until a good proportion of the trees were showing a ripe crop. It was decided, meantime, to use daily paid labour, allow no branch breaking, and pick when first, and as long as, a pishi (4 pounds) of ripe cloves were showing on a tree. To deal with 600 trees in a quickly ripening harvest such as was the case in the late *vuli* crop of 1934-35, one hundred pickers working on these terms were not too many. The daily rate of 8 annas would pay for the picking of 5 pishi (20 lbs.) at 6 pice a pishi. 20 to 80 lbs. of ripe cloves were commonly offering on a single tree in one day during that harvest. The main 1933 crop shows the following analysis of maximum amounts harvested in any one day in lots of a hundred consecutively numbered trees:—

No.	Tree Blocks.	Largest day's picking lbs. cloves.	No. of Trees Subscribing.	Date.
A	1—100	727½	37	7th July, 1933.
B	101—200	762	38	14th July, 1933.
C	201—300	873	51	14th July, 1933.
D	301—400	497	27	21st July, 1933.
E	401—500	467	19	7th July, 1933.
F	501—600	663	21	7th July, 1933.

Thus on 7th July, 1,857½ lbs. of cloves were picked from blocks A, E and F; the day labour equivalent at 20 lbs. per man would be 97 man days. This was in 77 trees which might represent a day's crop offering in three acres, which is of particular interest in considering the capacity of a small holder to deal with his harvest by using only family labour. It will be seen, from a glance at the figures for block B containing trees Nos. 201-300, that a single acre of cloves, containing 55 trees, might show such a large quantity of ripe buds that 15 men days, picking 15 pishi or 60 lbs. per man, would be required to remove the crop.

In the case of a small holder this labour would have to be done within a week in order to avoid loss of crop and to prevent the inclusion of two great a proportion of over-ripe and headless cloves. The variation in harvests is evident in respect of three blocks under observation:—

		K B S	K P A	M L B
1933	<i>Mwaka</i>	Heavy	Heavy	None
1933-34	<i>Vuli</i>	None	Little	Little
1934	<i>Mwaka</i>	Light sporadic	Light sporadic	Moderate sporadic
1934-35	<i>Vuli</i>	Heavy	Heavy	Heavy

Effect of Cultivation in “Die-back” Area.—In this experiment on old clove trees showing extensive “die-back” various cultural treatments were continued with the object of finding out if such treatment would be effective in checking “die-back” and so prolonging the economic life of the trees. Treated plots alternated with controls in which only simple slashing of the grass and weed growth was practised. The average yield of the treated plots was 12 lbs. of dry cloves per tree as compared with 8 lbs. for the control plots. The difference is evidently in favour of treatment, while mulching and hoeing twice a year gave the best results. The average yield over all the plots was 10 lbs. per tree. The experiment will have to be continued for several years to yield really significant results.

Yield Plots.—Blocks of about 20 trees of known age, or approximate so, have been selected in various estates, individually numbered and quadrat charted with a view to getting reliable information as to the yield of a clove tree at the various stages of its life and to working up a system of plantation forecasts of yield by recording the estimates of the proportions of a full crop they are expected to bear and then comparing these estimates with the actual yields. Information on the duration of the harvest on individual trees and on the blocks will also be obtained. The charting showed that right angle planting was rare and that a common planting distance was $25' \times 25'$.

Pollarding Observation.—Two rows of pollarded saplings, about 10 years old, have bushed out well; the nature of the branch growth is being observed.

Nutrition Deficiency Trial.—Thirty clove seedlings have been established in half drums (20 gallons) in wind sorted and rain leached sterile sand imported from Tanga. The first attempt to establish seedlings transplanted direct from nursery beds proved a failure, as did an effort to use plants which had been reared in bamboo pots. In both cases the seedlings proved unable to recover from the damage resulting from clean washing of the roots. The third attempt which proved successful consisted in lifting plants from the nursery with a cylinder of earth, packing them in wrappings made from the base of banana leaf sheaths and keeping them under shade for 3 months before planting out. The root systems were strong enough to recover from damage incurred as a result of washing free from soil.

The containers are set under shade on rails about two feet off the ground and the plants are arranged in five rows, each row containing 6 plants. All the plants are derived from 3 parent trees, two plants from each parent being arranged in each row. The central row is the control which receives the full nutrient solution advised by Dr. Wallace in his trials with fruit trees at Long Ashton. On either side are lines deprived of phosphates, nitrogen and potassium in their nutrient solutions and one line of grassed pots receiving full nutrient.

The plants receive half a litre of rain water for six days and the nutrient solution on the seventh day of each week, and once a fortnight a solution containing the rarer minerals such as boron and manganese is applied. The main object is to find conspicuous symptoms of deficiencies in foliage, bark and shoots and to compare the grassed pots with the others for signs as to which particular nutrients are competed for by the grass cover. A weekly description is made of leaf colour and condition, and leaf fall is recorded. Once every month the whole leaf equipment is described in accordance with a set formula, and height and branch growth and other measurements are recorded. It will not be possible to draw even preliminary conclusions for some time yet.

Pests and Diseases of Cloves.

Termites.—Termites have been responsible for deaths in planted out seedlings; in some cases stems have been cut right through, evidently to obtain quickly a food supply of dead plant material, and in other cases the removal of bark along the stem has been the cause of death.

Crickets.—Crickets of large size have damaged seedlings in the nursery and in the field by lopping off branches and shoots.

Scale.—Scale similar to Mussel Scale of Citrus was observed on debilitated seedlings in the nursery.

Leaf Curling Spider.—Inhibits shoot growth.

Seed Borer.—A lepidopterous insect is responsible for boring and spoiling about 4% of seed.

Cockchafer.—The question of cockchafer damage first raised by Professor Troup as being associated with “die-back” is still under investigation. A cage trap has been constructed round a clove tree showing conspicuous signs of “die-back” and adult chafers emerging from the soil are caught and recorded.

Maji-ya-Moto Ants.—(*Oecophylla smaragdina*). Monthly observation are being recorded throughout a complete year in the study of this enemy of clove

pickers. The discovery of winged forms modifies ideas on grease banding as a preventive of migration.

"Sudden Death".—Mortality due to this disease seemed to be on the increase and only guesses could be hazarded as to the predisposing cause of the increase while the primary cause, evidently a root fungus, is still unknown. A block of 800 trees on Machui Plantation has been quadrat charted and every fifth tree numbered with the object of studying the progress of the disease. A water pump for the exposure of root systems has been imported and fitted, and attempts to infect young plants are to be made. This disease is not without its advantages as it attacks and kills only older trees and so maintains, by the gapping of casualties, the proportion of the younger age classes.

Coconuts.

Present Position.—Recording of nut yields and preparation of copra from selected palms is being continued but further experimental work on coconuts will not be organized until the records of the uniformity trials up to April 1935 are analysed.

Coir Investigations.—Coir was prepared from husk which had been retted in sea beach pits for 11, 12, 13 and 15 months. The yields were 95, 68, 35 and 27 lbs. of coir respectively from the husks of 500 nuts and good quality coir was obtainable in all cases. The experiment is being continued, using pits each with the husks from 1,000 nuts.

Other Orchard Crops.

Oranges.—Budwood from 52 trees selected in the best orange producing areas in the island of Zanzibar has been utilized in propagating the best of the local oranges which have proved superior to any imported varieties. Rough lemon seedlings have been used as stocks.

Grape Fruit.—Of grape fruit, the Foster, McCarthy, Ellen and Cicely varieties have proved sufficiently good to warrant further propagation by budding on rough lemon stocks.

Orchard Extension.—There has been an increasing demand for planting material and the orchard has been considerably extended. The collection has been made up from superior local varieties and importations particularly from Ceylon and the Far East, and now includes: Anona spp., Avocado (*Persea gratissima*), Banana (*Musa* sp.), Carambola (*Averrhoa Carambola*), Cashew (*Anacardium occidentale*), Citrus spp., Durian (*Durio zibethinus*), Eugenia spp., Guava (*Psidium Guyava*), Jack fruit (*Artocarpus integrifolia*), Litchi (*Nephelium Litchi*), Mango (*Mangifera* spp.), Mangosteen (*Garcinia mangostana*), Pawpaw (*Papaya* spp.), Pineapple (*Ananas sativus*), Rambutan (*Nephelium lappeaccum*), Soursop (*Anona mureata*), Sapodilla (*Achras sapota*).

Distributions.—Nursery stocks other than cloves are now being raised and during the year 944 plants including coffee, pawpaw, budded oranges and various fruits were distributed. A stock of 300 flamboyant seedlings was raised for roadside planting.

New Importations.

Essential Oil Plants and Spices.—A collection of local and imported essential oil yielding plants has been made with a view to study and trial. Importations include *Andropogon odoratus* and *Zizanoides* from Java, *Pogostemon Cablin* from Java and Ceylon and *Cinnamomum zeylanicum* from Ceylon.

Selections of nutmeg, Areca nut and *Piper nigrum* were imported from the Netherlands East Indies, British Malaya and Ceylon and established.

Oil Palms.—A thousand oil palm seeds of the Deli type were imported from Java and seedlings were successfully reared with a view to establishing an oil palm having a good pericarp. The local palm produces a nut which has practically no pericarp but a large kernel.

Fibres.—*Pandanus textorius* was introduced from Java to provide materials suitable for making mats for clove drying.

Cover Crops and Green Manures.

Tephrosia candida is proving very useful as a "nurse" crop for planted out clove seedlings, and is likely to be adopted in estate planting practice. It stands lopping to almost any extent thus allowing of efficient shade control besides providing material for green manuring.

Mucuna utilis grows vigorously, providing an excellent cover for weed control and ample green manuring material. It seeds abundantly.

Calapogonium mucunoides forms an extraordinary thick cover and regenerates well from self sown seed. It is being used as a cover between young clove trees.

Centrosema pubescens is more difficult to establish, is slower in growth and does not form such a thick cover.

A number of introductions have been made from Amani and the Far East and are under observation.

Annual Crops.

Weather.—Climatic conditions in the early part of the year were favourable to annual crops and good yields were obtained, but the late rains were too sporadic with sudden heavy falls in October and December, and late planted crops practically failed.

Maize Seed Selection.—Early planted maize from locally selected seed gave a yield of 3,214 lbs. of dry cobs per acre, equivalent to 2,442 lbs. of dry grain per acre.

Maize Manurial Trial.—A simple straightforward manurial trial gave the following results:—

"Complete" fertilizer	—4 cwts. per acre	1,928 lbs. per acre—dry grain.
Superphosphate	—3 " " "	1,824 " " "
Sulphate of Ammonia	—1 " " "	1,384 " " "
Control	—No manure	1,000 " " "

This again indicated clearly the lack of phosphate in the Kizimbani soils, a deficiency which is probably general throughout Zanzibar Island.

Maize Liming Experiment.—Locally burnt lime was applied in two dressings at rates of 5, 10 and 20 tons per acre. The first dressing was given in the early rains and was followed by a mucuna crop; the second was given when the mucuna was cut and buried in preparation for planting a late maize crop. Briefly the results were: a 5-ton dressing doubled the yield and a 10-ton dressing trebled it, as compared with no lime. The 20-ton dressing increased the yield by less than two-thirds. The cost of lime at the station was Rs. 12 per ton. The advantage of liming seems evident; the experiment will be continued to test residual effects.

Sorghum.—A preliminary trial with three lots of seed from Tabora, Lindi and Kilwa on the Mainland was carried out. The average yield was 1,120 lbs. per acre obtained from a harvest which indicated extraordinary variation in plant material. Selection has been carried out for future trials.

Bullrush Millet.—A one-acre plot was somewhat uneven but the result was such as to justify further trial of a crop which is already grown on the *wanda* (Coral rag) country, and might be more widely cultivated.

Eleusine Coracana.—The yield from imported India seed was not promising. This crop is probably better suited to the drier East Coast areas.

Rice.—The Java Hill rice, tried in 1933, again failed and is evidently unsuited to Zanzibar conditions. Several local swamp rice varieties were grown but organized work in rice is being deferred until a comprehensive scheme for investigation can be initiated.

Groundnuts.—(*Arachis hypogaea*). After three trials this crop has proved unsuitable for cultivation at Kizimbani Station. Close spacing (12 inches in 3 rows per five foot ridge) definitely decreased the incidence of disease, and doubled the crop as compared with a two-foot spacing with two rows per ridge.

Bambarra Groundnut.—(*Voandzea subterranea*). A one-acre plot cleared in readiness for Yams in 1933 was sown to Bambarra groundnuts to provide a cover and possible catch crop. Late planting and unfavourable weather prevented the maturing of a crop, but an excellent cover was obtained with no evidence of disease. It has therefore been decided to try the Bambarra nut as a substitute for the common groundnut.

Madagascar Bean.—A further trial proved that this crop is not suitable for Zanzibar.

Gram.—(*Phaseolus Mungs*). Late planted green and black grams did not succeed, but with a proper planting time and favourable weather conditions, they are distinctly promising.

Cassava.—As the staple food crop of the Protectorate, the cultivation of cassava *muogo* is receiving considerable attention. A study is being made of the local varieties, and in addition 26 varieties, have been introduced from Amani and 4 from Java for testing against the local product. The virus problem is a serious one and efforts are being made to find stock which is resistant while still retaining other essential qualities. Varietal yields have been up to 18,688 lbs. of fresh roots per acre.

Sweet Potato.—In local variety tests which are still proceeding, "Dunga" gave a yield of 9,800 lbs. per acre.

Live Stock.

Bullocks.—Trypanosomiasis took toll of two transport bullocks during the year.

Poultry.—The table giving the monthly egg yields shows that an average number of 33 Rhode Island Red Hens laid an average of 138 eggs per bird during the year.

EGG YIELD OF RHODE ISLAND RED HENS.

TABLE.

Month.	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Eggs	324	367	368	335	375	350	482	460	448	432	302	247
Hens	22	28	30	32	34	36	40	40	40	40	24	24
Average per hen	14.73	13.11	12.27	10.47	11.03	9.72	12.05	11.50	11.20	10.80	12.58	10.29

The poultry remained in very good health, and there is no doubt that close attention to cleanliness in the houses and runs and good feeding prevented the ingress of fowl cholera which was rampant in Zanzibar for a period. The stock was increased from 80 birds in January to 258 in December. The Aylesbury Duck stock was increased from 3 to 15. During the year 767 eggs were sold for setting in addition to those utilized by the Department. Sixteen cockerels were sold for breeding at an average price of Rs. 4 each.

Other Activities.

Clove Drying Mats and Mat Bags.—As the Protectorate imports large quantities of drying mats and mat bags for packing cloves, an investigation into the possibilities of local production was begun. Imported mats come from Muscat and the Mainland Coast and are made from the leaves of *Hyphæne coriaceæ* and an unknown palm (probably *Hyphæne* species) indigenous to Baluchistan. A survey of local fibres revealed that *Phoenix reclinata Mkindu* *Hyphæne coriaceæ Mwaa*, *Borassus flabellifer Mvumo* *Pandanus* species *Mkadi* and *Cocos nucifera Mnazi* might provide suitable material, and mats and bags were made to put under test.

Tree Planting on Wanda Country.—In this minor investigation, only *Cassia siamea* and *Acacia confusa* have shown signs of satisfactory establishment in the soil pockets of the coral rag or *wanda* country.

Land Enquiry.—The Silviculturist and the Agricultural Officers attached to the Experiment Stations assisted Sir Ernest Dowson in his Land Enquiry, and prepared tables and maps recording estimates of land utilization in the Protectorate. This estimate is probably the most thorough yet made and should form a useful basis for an intensive agricultural survey which is urgently required. The estimate revealed that in Zanzibar Island coconuts probably occupy about six times as much land as cloves, and that nearly half of the island is occupied by bush. Mangroves (Tidal Woodland) are estimated to occupy 11,800 acres.

Study Tour in the Far East.—Under the auspices of the Carnegie Corporation, Mr. R. Johns, Agricultural Officer, was enabled to undertake a study tour lasting six months during which he visited Malaya, Ceylon and Java. He made an intensive study of cloves and coconuts in these countries and investigated minor tropical crops likely to be suitable for introduction to Zanzibar. He accumulated a great deal of valuable information on tropical agriculture and introduced to Zanzibar a large and valuable collection of economic plants.

Financial.—Revenue figures for the station show that sales of cloves and clove stems realized Rs. 17,798.96 and coconuts and copra Rs. 13,996.49 out of a total revenue of Rs. 33,472.98. These figures represent actual receipts during 1934, and therefore, include proceeds from the sale of a small carry over of 1933 produce, but do not include sales of late 1934 produce made in 1935 which was considerable owing to the late clove harvest. Excluding personal emoluments for the Silviculturist and the Agricultural Officers-in-Charge, Recurrent Expenditure was Rs. 101,456.40 and Special Expenditure Rs. 3,710.06, a total of Rs. 105,166.46. Summarized, the financial position was :—

Expenditure :—	Rs.	Cts.
Personal Emoluments (non-European Staff) ...	23,335	26
Labour ...	61,402	29
Other Charges ...	16,718	85
Special Expenditure—staff quarters, etc. ...	3,710	06
	Rs. 105,166	46
Revenue :—		
Sale of cloves and clove stems ...	17,799	00
Sale of coconuts and copra ...	13,996	00
Sale of other sales ...	1,678	00
	Rs. 33,473	00

EXPERIMENT STATIONS, PEMBA.

Demonstration Centres.—The Pemba Stations are not experimental in the strictest sense of the word: they might more aptly be described as trial and demonstration centres subsidiary to the central station at Kizimbani in Zanzibar where intensive experimentation is being concentrated. Yet conditions in Pemba differ so much from those in Zanzibar that it is essential to have stations at which approved methods and practices can be tried out under Pemba conditions, and finally demonstrated to the local agriculturists when they have been proved. Thus the movement of the Department's activities in Pemba is definitely towards demonstration and extension work, which can only be gradually organized as an African instructional staff must be trained and contact established with the local agricultural community.

Staff.—It has not yet been possible to provide the full complement of two European Agricultural Officers in Pemba. Mr. Baker was in charge for the first six months of the year and was relieved by Mr. Soper for the remainder of the year. The field staff consisted of six African Assistant Overseers and seven Headmen. The clerical staff numbered two. When the Adulteration of Produce Decree came into force a Produce Examiner was sent to Pemba to work under the supervision of the Agricultural Officer who is officially the Inspector of Produce for Pemba.

Weather.—The year started hot and dry but a plentiful rainfall came in March and continued until the middle of July, the months of heaviest falls being May and June when there were 33.64 inches and 15.26 inches respectively at Wesha. A long dry spell broken only by showers, ensued until the end of November when the short rains broke but they lasted for only a fortnight.

Estate Work.

Cloves.—Heavy clove crops were harvested at Makondeni and Matangatwani, while crops at the other three stations were rather below average. Fortunately the harvest in the south of the island was practically finished before the heavy crop in the north matured, which enabled a transfer of picking labour to be effected. No imported Zanzibar labour was employed. Picking rates ranged from 4 to 7 pice per pishi. The yield of cloves for the five stations was 2,192 frasilas as compared with 2,688 for 1933.

Coconuts.—Coconut crops were about normal, 1,855 frasilas of copra were prepared and 22,924 nuts sold as compared with 1,885 frasilas and 17,497 nuts in 1933.

Buildings.—A combined store and rest house was built at Makondeni and additional labourers' quarters were provided at Makondeni and Matangatwani. A poultry keeper's house and store was constructed at Wesha and a small demonstration copra kiln with a nut capacity of 750 and costing only Rs. 54 was built at Matangatwani.

Experimental Work.

Cloves.—Nurseries at the five stations were supplied with 32,000 seed from selected trees to provide stocks of seedlings for distribution and estate planting.

Work in old clove stands at Makondeni and Tundaua was confined to yield observations. The plots of ten year old trees at Makondeni benefitted much by two thorough cultivations. A parent tree trial was laid down at Fufuni using the progeny from 9 parent trees planted out in lines of 30 plants each. Banana pot seedlings were used and made good progress.

The five acre shade tree trial at Fufuni was replanted after failure owing to drought in 1933, but made poor progress. The shade trees are *Albizia mollucana*, *Pterocarpus indicus*, *Cassia siamea* and *Gliricidia maculata*.

Coconuts.—The five acre block of experimental planting on low lying land close to the beach at Tundaua has made poor progress owing to difficulty in providing efficient drainage. Yield records of selected palms are being maintained on all stations and nursery supplies are provided from selected nuts.

Citrus Fruits.—Trees budded in Zanzibar in 1932 and planted out about a year later have made excellent growth at Wesha where a citrus orchard is being established. Similar trees at Matangatwani and Fufuni have not done very well. Conditions there are not suitable for citrus cultivation.

Fruit Orchard.—There is a definite demand for fruit trees in Pemba where fruit is generally scarce and to meet this demand a fruit orchard with nursery is being established at Wesha.

Annual Crops.

Cassava.—This being the most widely cultivated crop in Pemba, it is important to investigate local varieties and test them against imported varieties with a view to improvement, with particular reference to finding a variety that is resistant to the widespread virus disease, *Mosaic*, and yet is a good yielder. Trials of four varieties, differing at each station, were planted up in May at Wesha, Fufuni and Matangatwani. In all cases the planting material was found to be uneven and not true to type, although some of the Matangatwani plantings turned out reasonably pure, and can be used for further selection. Virus counts taken in July, i.e. after two months showed heavy infection. In

December a further selection of local varieties was made for planting up at Matangatwani. At Wesha some forty selected plants were raised; at 3 to 4 months they were 7 to 8 feet high, but many showed signs of virus attack.

Sweet Potatoes.—Variety trials were laid down at Matangatwani and Fufuni, which provided valuable information as to maturation periods, purity of strains, varietal characters and yields.

Groundnuts.—Yields were poor, but further experiments, in time of planting and spacing are indicated.

Maize.—Observation plots planted rather late in the season gave uneven results and poor yields. "Leaf stripe" was prevalent and extensive damage was done by stem borers and white ants.

Rice.—Attempts were made to sort out the Pemba varieties and 15 of them were cultivated at Tundaua on low lying but not swampy land. An average yield of 683 lbs. per acre might have been increased by more extensive thinning. Investigations are being continued, and 50 local varieties were collected and described.

Madagascar Beans.—These have definitely proved unsuitable for cultivation in Pemba.

Bullrush Millet and Green Gram gave disappointing results.

Cover Crops.

Mucuna utilis has done well on fair and good soils but is difficult to establish on exhausted land.

Calopogonium Mucunoides sown at the end of the long rains has been slow to move but eventually makes an excellent cover. It promises well but for optimum results, should evidently be sown at the beginning of the long rains.

Centrosema Pubescens.—This has proved an excellent long term cover crop; and vigorous growth was evident on plots which were nearly two years old. Interplanted with Citrus trees, it is a serious competitor for soil moisture during the dry weather.

Tephrosia candida has done well except on the water-logged coconut plots at Tundaua. It flowers profusely but is still a shy seeder.

Indigofera species have not proved of much value.

Poultry.—The small poultry farm at Wesha was successfully maintained. The average number of laying birds was 14; egg production was 1,723, of which 400 were sold for setting. Nine cockerels were sold at prices ranging from Rs. 5 to Rs. 8.

Extension Work.

Clove Nurseries.—In addition to those at the Department's Stations four district clove nurseries were established and supplied with 15,000 seed from selected trees. Supplies of seedlings from the latter were all overbooked and at the end of the year provision was being made for increased stock at these popular nurseries, and a new nursery was being established at Mtambili. With a view to further organization of extension work, a study of local agricultural practices and crops was started.

AGRICULTURE IN PEMBA DURING 1934.

As Clove and Coconut crops in Pemba have been dealt with in an earlier part of this report, food crops only will be discussed under this heading.

Rice.—The outstanding feature of the year was the unusually large area put down to this crop. On the western half of the island, many hill sides were cleared for the planting of hill rice, and valley cultivation was more extensive than normal, but an even more noticeable feature was the increase of planting on the flat semi-upland areas of the eastern half of the island. A large number

of varieties was utilized in planting, but in general it seems that a rather long thin type of grain is preferred as giving good cooking quality. Very few of the hill types are of this description. The season was a favourable one; a long moist growing period being followed by dry weather for ripening and harvesting. Yields were generally above average.

Cassava.—The prolific early *masika* rains proved unfavourable to plantings which were made with the intention of providing a crop to be harvested during *Ramadhan* in January, 1935. Cuttings rotted owing to excessive moisture and cases were reported where three plantings were necessary before a satisfactory stand was obtained. This experience evidently had its effect, for extensive planting in the western areas was carried out during the short rains in December. This, curiously enough, coincides with the opinion of the Plant Pathologist at Amani that planting during the short rains tends to lessen virus attack. If, in addition, the planter would realize the necessity for using clean cuttings from virus-free plants, he would do much to reduce the incidence of *Mosaic* in his cassava crop. This practice is being preached, and further propaganda in this respect is being contemplated as an important item in extension work.

Sorghum crops in the coral rag country were reported as being up to average.

Sweet Potatoes.—Production was normal.

Tobacco.—Good crops were reported from Vereni in October. Cultivation in other areas, with the exception of Mowambe, was not extensive.

Land Enquiry.—Mr. Soper assisted Sir Ernest Dowson in his enquiries in Pemba and afterwards prepared a crop distribution map with relevant figures.

GOVERNMENT PLANTATIONS.

Staff.—Mr. Squire, Manager of Plantations preceeded on leave in August and was relieved by Mr. Baker, Agricultural Officer, who was in charge of Plantations for the remainder of the year. The substantive clerical staff numbered three, but owing to leave arrangements only two clerks were on duty for the major portion of the year. The field staff consisted of two Head Overseers, nine Assistant Overseers and five Headmen in Zanzibar, with one Headman in Pemba.

Government Plantations in Pemba are now of minor importance, consisting as they do of a few small isolated areas of little value and some town areas, all of which are supervised by the Agricultural Officer in Pemba. All crops on Government Plantations in Pemba are leased. The following comments, therefore, apply to Government Plantations in Zanzibar only.

Labour—On 27th March, the rate of pay for casual plantation labour was reduced from 8 to 7 annas per day. In spite of the reduced rate, supplies were sufficient except during the clove harvest at the end of the year when practically all labour was diverted to clove picking. Competition from private plantation owners during clove harvest caused a shortage of clove picking labour on Government Plantations where every effort is made to keep picking rates reasonable. Private owners do not hesitate to pay even uneconomic rates in order to pick all the crop and so realize cash on it. The quality of the ordinary labour which is of mainland origin, was up to standard and general health was good.

Crops.

Cloves.—From the point of view of clove production the year was a peculiar one, owing particularly to the influence of the drought conditions which characterized 1933. A second flush of late 1933-34 crop appeared in January and February 1934 and tailed off very suddenly in March; 1,309 frasilas of dry cloves were produced during that period. The main or *mwaka* crop started in June in a small way and continued until September, but proved a very meagre crop. The late or *vuli* crop turned out to be the main one in the 1934-35 season, and started in October, immediately following the main crop. The production figures for the Government Plantations from January 1934 to February 1935

are interesting as showing the general trend of production during a peculiar season :—

	1934.	Green Cloves—lbs.	
January	...	54,071	} <i>Vuli</i> crop.
February	...	74,334	
March	...	1,574	
April	...	—	
May	...	8	} <i>Mwaka</i> or main crop.
June	...	10,622	
July	...	34,792	
August	...	52,965	
September	...	50,399	
October	...	205,427	} <i>Vuli</i> crop.
November	...	446,418	
December	...	295,659	
1935.			
January	...	361,427	} <i>Vuli</i> crop.
February	...	29,776	

The actual production of dry cloves from the Government Plantations for the calendar year was 11,026 frasilas, and for the crop year 1934-35 upto March 1935 it was 13,193 frasilas. This compares with 6,399 frasilas for 1933-34 season.

In the crop year, the production worked out at 8.78 lbs. of dry cloves per tree. This figure was much in excess of original anticipations when a crop estimate was made early in the year, because as already pointed out the usual order of things was reversed, the main or *mwaka* crop being the small one and the late or *vuli* crop the heavy one. Evidence of this heavy late crop did not appear until June and July. The general average for the Government Plantations in 1933 was 3.247 lbs. per tree, which was low; an average of 8.78 lbs. per tree represents a heavy crop.

An example of variation in production seen in the yield of the Masingini estate which contains many fine clove trees is given below :—

Year.	Cloves Yields at Masingini.		
	Frasilas.	lbs.	lbs. per tree.
1932	2,720	95,200	14.68
1933	45	1,575	0.24
1934	1,004	35,140	5.42

Throughout the whole season practically all trees produced clove buds, which appeared and matured at varying periods even in individual trees, thus complicating picking arrangements. In spite of this only a small proportion of the crop had to be left unpicked as being uneconomic.

Picking labour was plentiful in the early part of the season, but scarce at the height of the harvest when the Government Plantations had to compete with private owners who raised prices unduly to attract pickers. The picking rate started at 4 pice per pishi on all plantations; when the heavy crop matured from October onwards the rate had to be raised to 5 pice; at Selem the rate had to be 6 pice at the end of November in order to ensure that the crop would be picked.

Weather conditions were not particularly favourable for drying, October and December being definitely wet months, but the general quality of cloves produced was very good. During part of October and November the copra kilns at Selem were utilized for clove drying. With careful firing, drying was completed in 12 to 15 hours and the resulting product was of excellent quality. Those kiln dried cloves were sold separately and realized a premium over sun-dried because of their brightness.

The average loss of weight on drying was 68.96% and the proportion of stems to clove buds was 23.86%.

The year was generally favourable for growth and the incidence of die-back and disease was not high, although "sudden death" was frequent amongst well-grown and healthy-looking trees at Machui.

Ordinary maintenance work was carried out and additional cultivation in the form of hoeing was commenced at the end of the year. No regeneration was done but preparations were being made for planting during the early 1935 rains.

The average price of Government Plantations cloves sold in 1934 was Rs. 6.87 per frasila, as compared with Rs. 7.05 for 1933. In January the

price touched Rs. 7 and fell to Rs. 5.75 in April. Thereafter there was a sharp rise which was maintained until August when the price reached was Rs. 8.60; there was a fall to Rs. 6.85 in December. Price levels for Government Plantations' cloves indicate the trend of prices for best quality Zanzibar cloves.

The production of stems amounted to 3,148 frasilas for the season which sold at exceedingly low prices varying from Re. 1 to 60 cents per frasila, giving an average price of 93.6 cents as compared with Rs. 1.55 for 1933.

Coconuts and Copra.—Nut production was above average at 40.80 nuts per palm from 65,021 bearing palms. This compares with averages of 39.28 and 31.95 nuts per palm from 1933 and 1932 respectively. During the year 2,342,422 nuts were husked and produced 24,310 frasilas (380 tons) of copra, which represents a rate of 10.38 frasilas per 1,000 nuts or 6,164 nuts to a ton of copra. Sales of whole nuts amounted to 1,172,013 at prices ranging from Rs. 6 to Rs. 11 per 1,000.

Plantations copra was always in demand, particularly for local milling, at a minimum premium of 4 annas a frasila or Rs. 16 a ton over ordinary Zanzibar copra. Local market prices were very low during the year, varying from 13 annas to one rupee in June after which the price dropped again to between 13 and 14 annas per frasila until September. By the end of December the price stood at Rs. 1-6 on a rapidly rising market. The maximum price of Rs. 1-14 annas for Plantations' copra was reached in October, but the average sale price for the year was only Rs. 1-25 cents (Rs. 1-4 annas), which represents an unprofitable figure for copra production.

On account of prevailing low prices, production costs had to be reduced; rates for coconut gathering, husking, breaking, etc. were cut accordingly: climbing from 64 to 80 trees per rupee; collecting from 5 annas to 4 annas per day; gathering from Rs. 1.50 to Rs. 1.25 per 1,000 nuts; husking from 13 annas to 10 annas per 1,000 nuts and breaking from Rs. 1.50 to Rs. 1.25 per 1,000 nuts.

Sun-dried copra was produced as weather permitted but the bulk was kiln-dried on simple locally constructed kilns. On account of copra production being unprofitable, cultivation costs were reduced to a minimum and only periodic slashing was carried out. No regeneration was done, but systematic thinning of overcrowded areas was continued.

Buildings.—Two new copra kilns of 4,000 and 2,000 nut capacity were built at Selem and Machui. A new store at Machui was almost completed at the end of the year and a combined house, tool and produce store was in course of construction at Mtoni.

Disposal of Plantations.—At Mahonda 80 acres of clove bearing land were divided up into 52 small holdings varying in size from one acre to five acres. These were disposed of to selected small holders on easy terms. Part of Kitope was divided up into large holdings of about 70 acres each.

Finance.—Produce prices during the year stood at a very low level, particularly in the case of copra and coconuts, but thanks to a good clove crop the year's working shows an excess of revenue over expenditure of Rs. 23,757.43. The summarized position compared with 1933 is as follows:—

Revenue.	1934.	1933.
Cloves and Stems	... 80,461	36,308
Copra and Coconuts	... 36,885	58,434
Miscellaneous	... 1,273	1,336
	Rs. 118,619	96,078
Expenditure.		
Headquarters Charges	... 18,995	16,690
Field Staff	... 10,090	12,358
Labour	... 56,139	56,892
Other Charges	... 9,638	11,641
	Rs. 94,862	97,581
Excess of Revenue over Expenditure	Rs. 23,757	
Excess of Expenditure over Revenue		Rs. 1,503

For three years the revenue and expenditure figures are:—

	Revenue.	Expenditure.	Surplus.	Deficit.
1932	201,935	191,367	10,568	—
1933	96,078	97,581	—	1,503
1934	118,619	94,862	23,757	—

Comparing 1934 with 1933 revenue, the increase for clove products in 1934 is due to an increased crop with average clove prices for the two years at Rs. 6.87 and Rs. 7.05 per frasila respectively. The decrease in the revenue for coconut products in 1934 was entirely due to a fall in value with average copra prices for the two years at Rs. 1.25 and Rs. 1.52 per frasila, and a corresponding fall in the value of whole nuts.

An examination of the returns from mixed clove and coconut plantations as compared with pure coconut plantations illustrates the unprofitable nature of the latter with the prices of coconut products at the low levels prevailing in 1934. The two principal mixed estates, Machui and Selem, showed profits of Rs. 5,362.38 and Rs. 11,009.81 respectively, while the pure coconut estates, Mtoni and Chukwani, showed losses of Rs. 1,175.90 and Rs. 1,297.65 respectively. Considering that it was a year of low produce prices, the financial position at the end of the year may be regarded as satisfactory and reflects credit on the management.

PRODUCE INSPECTION.

Legislation.—The year was marked by the introduction of two Decrees which closely affected inspection of cloves. Under the Adulteration of Produce Decree, the sale or export, or possession for sale or export of cloves which contain more than 16% of moisture and more than 5% of extraneous matter, or are otherwise adulterated is prohibited. The Agricultural Produce Export Decree provides for the inspection and grading of cloves.

Inspection.—The Decrees were put into operation in July and October, 1934 respectively, and have done a great deal to improve and regulate the quality of Zanzibar cloves. During the year under review 155,799 bales of cloves, composing 1,924 consignments were presented for inspection; 10,786 bales in 147 consignments were rejected as being below standard, and had to be re-conditioned. This represents a high percentage of consignment failure at 7.6%, and bale failure at 6.9%. The following table gives the position for the years 1931 to 1934 inclusive:—

Year.	Inspected.		Failed.	
	Consignments.	Bales.	Consignments.	Bales.
			%	%
1931	2,604	147,814	2.5	1.9
1932	2,867	113,781	3.0	2.9
1933	4,018	148,724	2.9	3.2
1934	1,924	155,799	7.6	6.9

The decrease in the number of consignments inspected during 1934 is due to an increase in the size of consignments consequent upon the stopping of the practice of splitting up single shipping consignments into small lots for presentation for inspection. The number of failures in the early months of the year was excessive owing to certain exporters trying to off-load old and inferior stocks, and gradually decreased from 62 in the first quarter to 55 in the second, 25 in the third and 5 in the fourth. The drop after July is entirely due to the operation of the Adulteration of Produce Decree throughout the Protectorate.

During the year 1,889 samples were examined, 1,844 for extraneous matter, 40 for excessive moisture and 5 for both moisture and extraneous matter; only 7 were failed for excessive moisture.

The following table gives the monthly detail of inspection :—

Month.	Inspected.		Passed.		Failed.	
	Cons.	Bales.	Cons.	Bales.	Cons.	Bales.
January	221	17,249	204	15,699	17	1,550
February	222	16,999	185	14,030	37	2,969
March	161	11,833	153	11,289	8	544
April	184	11,721	162	10,191	22	1,530
May	215	18,162	197	17,067	18	1,095
June	132	10,959	117	9,557	15	1,402
July	146	13,882	141	13,517	5	365
August	185	20,187	175	19,552	10	635
September	224	20,352	214	19,898	10	454
October	49	2,433	49	2,433	—	—
November	99	5,351	97	5,291	2	60
December	86	6,671	83	6,489	3	182
	1924	155,799	1777	145,013	147	10,786

The number of bales passed during the year was 145,013 as compared with 143,930 in 1933 and 110,499 in 1932. Inspection fees collected amounted to Rs. 13,477.55 cents. Table No. III gives monthly details of the export of cloves and clove stems and Table No. IV gives destinations.

Grading.—Official grading came into operation on October 1st, 1934, when the following grades were introduced under the Clove Grading and Export Rules, 1934 :—

Special Grade.—Good sound cloves which are whole, bright, bold, uniform, regular, free from mustiness and which contain not more than—

- 3% of stems, mother of cloves, and foreign, superfluous or inferior matter.
- 2% of khoker cloves.
- 16% of moisture.

Grade 1.—Good sound cloves which are bold, reasonably regular, free from mustiness and which contain not more than—

- 5% of stems, mother of cloves, and foreign, superfluous or inferior matter.
- 3% of khoker cloves.
- 16% of moisture.

Grade 2.—Cloves which are free from mustiness and which contain not more than—

- 5% of stems, mother of cloves, and foreign, superfluous or inferior matter.
- 7% of khoker cloves.
- 16% of moisture.

Grade 3.—Cloves which contain not more than—

- 5% of stems, mother of cloves and foreign, superfluous or inferior matter.
- 20% of khoker cloves.
- 16% of moisture.

The basis of the grading was the requirements of the various markets, Special Grade cloves being suitable for the whole spice market in Europe and America, Grade 1 for the India market, Grade 2 for the clove cigarette trade in the Dutch East Indies and Grade 3 for distillation. There was a great deal of opposition to the introduction of this grading system, but by the end of the year its advantages were being appreciated and overseas buyers were specifying their requirements in accordance with the established grades and finding that expensive arbitration was gradually being eliminated.

CHEMICAL LABORATORY.

The Government Chemist who was on duty throughout the year, dealt with 305 samples for general analysis in addition to carrying out agricultural investigations. The distribution of the samples is shown in the following table :—

Department.	1st Quarter.	2nd Quarter.	3rd Quarter.	4th Quarter.	Total 1934	Total 1933
Agriculture	15	2	43	9	69	120
Health	29	25	52	67	173	120
Police	7	1	6	7	21	12
Customs	4	4	4	11	23	11
Other Departments	1	2	6	8	17	14
Private	1	—	1	—	2	2
	57	34	112	102	305	279

Notes on Samples.—The routine agricultural samples consisted of cloves, cattle dips, milk, coconut oil, copra, fertilizers, and citrus fruits. In 39 of the latter the "soluble solids/acid ratio" and juice content were determined to assist in the selection of material from local orange stocks for propagation. Generally the "ratio" was high and the juice content good.

The majority of the Health Department samples were aerated waters and syrups, and materials for their manufacture. Some Pemba samples of soda water contained excessive quantities of copper. Sweetened aerated waters were frequently badly contaminated. An investigation showed that contamination occurs almost entirely during the process of manufacture. Of milk samples from public supplies only five of nine were satisfactory. The deficiencies in solids-not-fat ranged from 14.7% to 53.4% and in fat from 15% to 48.3%.

In the Police samples, Opium was detected in six exhibits and Bhang in six.

From the Customs Department, only one sample out of six of methylated spirit was not denatured. A sample of "imitation tea" was found to consist of exhausted tea leaves treated so as to resemble genuine tea. The origin of the sample was India. Thirteen samples of condensed milk were found to comply with the new regulation prohibiting the importation of condensed milk containing less than nine per cent. of butter fat: five samples were rejected, one containing only 0.27% of fat.

The Clove Growers' Association submitted one sample of cloves for full analysis, four samples for oil content and four samples for oil and eugenol contents.

Agricultural Investigations.

Soil Survey.—Following upon the advisory visit in 1933 of the Soil Chemist of the East African Agricultural Research Station, Amani and his report entitled: "Sketch of Soil Conditions in Zanzibar and Pemba", soil investigations were continued, field work being confined mainly to Zanzibar Island where 132 samples from soil profiles were collected and described. Other exposures were examined and described, including two on the *wanda* land (pocket soils in corraline limestone rock).

Preliminary tests of pH value, thiocyanate test and lime requirement were made on the majority of the above samples. Detailed analyses have been deferred as it is considered more important to collect, compare and describe a large number of soil profiles in order to proceed with the classification of soil types. The Government Chemist collaborated in the preparation of a Soil Map of East Africa and a covering Memoir by preparing soil maps of Zanzibar and Pemba on a scale of 1:333,333 (for reduction in printing to 1:666,666) to allow of an inset in the main East African Map. The requisite explanatory Memoir was also forwarded to the Soil Chemist, Amani, who was preparing the map and memoir for presentation to the International Congress of Soil Science in 1935.

Clove Investigations.—The Government Chemist co-operated in the work on "nutrient deficiency" trials with clove seedlings established in pure sand, the details of which are given under the heading Experiment Station, Zanzibar.

In the long-term experiment on the storage of cloves under dry and damp conditions, samples were taken for analysis at the recognized intervals.

Distillations were made on clove stems, leaves, seeds and parts of seedlings and the characteristics of the oils determined. "Freak" cloves, in which there is an abnormal development and persistence of the inflorescence bracts and suppression of flowers, yielded on distillation 17.9% of oil similar to ordinary clove oil.

Investigations on the development of oil in clove buds were continued, and are not yet completed. Experiments on artificial drying and moisture determination in clove buds were undertaken.

Conference of Soil Chemists.

The second Conference of East African Agricultural and Soil Chemists was held in Zanzibar in August, local arrangements for the Conference being organized by the Government Chemist, Zanzibar. The Conference was attended

by delegates from Amani, Kenya, Uganda, Tanganyika and Zanzibar, under the Chairmanship of Mr. W. Nowell, C.B.E., Director of Amani. The subjects discussed included the Soil Map of East Africa, mentioned above, the registration of soil series names, green manuring, compost making, biological methods of assaying soil nutrients, erosion, and legislative control of fertilizers, feeding stuffs and pest-control chemicals. A full report of the Conference will be published as a Technical Report of the East African Governors' Conference.

VETERINARY BRANCH.

Charge of the Veterinary Services was transferred from the Medical to the Agricultural Department on 1st January, 1934.

Staff.—Of the normal staff of two Asiatic Veterinary Officers, one returned from leave on 10th June and the other proceeded to India on leave on 6th November. Two Veterinary Cadets (locally trained) and twelve Attendants were on duty throughout the year.

Legislation.—No new legislation was introduced but the "Diseases of Animals Decree" was amended to accord with the transfer from the Medical to the Agricultural Department.

An amendment to the Customs Tariff Decree No. 12 of 1932 reduced the import duty on cattle from Rs. 7.50 to Rs. 6 per head.

Diseases of Animals.

Contagious Bovine Pleuro-Pneumonia.—Cases of this disease were occurring spasmodically amongst the cattle at the Mji Mpia Dairies, and on the advice of the Director of Veterinary Services, Tanganyika Territory, inoculation of all the dairy cattle and possible contacts in and near the Town was carried out. The inoculation was carried out on 952 animals without a single casualty and was thoroughly effective in stopping the spread of this disease.

Rinderpest.—There was no outbreak in the Protectorate during the year, thanks to stringent quarantine regulations effectively imposed.

Trypanosomiasis.—Six cases were recorded amongst imported slaughter cattle in Quarantine out of 406 examined. In local cattle, the proportion was higher, eight positives in 45 animals examined. Total positives were higher in cows than in bullocks, the proportions being 8 in 280 and 6 in 171 respectively. Infections in one horse and one donkey, both local, were recorded. The infective organisms were identified as either *T. Congolense* or *T. Brucei*.

East Coast Fever.—This endemic disease, which causes considerable mortality amongst very young cattle stock, was diagnosed in only 2 cases out of 211 examinations of adult stock, local and imported.

Contagious Abortion.—Several cases occurred in the Dairies stock.

Septicæmia—This was responsible for two deaths in local cattle.

Tetanus.—One cases was recorded in a locally bred heifer.

Fowl Cholera.—This disease was rampant in Zanzibar for a period and caused a heavy mortality.

Pigaduri Quarantine Station.—A fourteen days quarantine is imposed on all cattle imported unless they are accompanied by a certificate from an European Veterinary Officer to the effect that they have been quarantined for at least ten days immediately prior to shipment, blood tested and temperatured twice during the quarantine period, are evidently free from disease and are being exported from an area the port of loading of which is free from disease. Sheep and goats are quarantined five days unless similarly certified.

7,324 animals of which 1,975 were cattle and 5,321 were goats and sheep passed through the Quarantine Station during the year. 285 infected and suspected cattle were slaughtered at the station.

The following table which gives comparative imports for 1931 to 1934 shows a progressive decrease in total imports of animals for slaughter due to diminution in meat consumption consequent upon trade depression :—

	1931	1932	1933	1934
Oxen	3,304	3,150	2,150	1,546
Cows	87	156	209	248
Calves	70	127	142	181
Goats	10,414	9,850	6,906	3,661
Sheep	3,424	3,191	2,236	1,660
Horses	6	4	1	1
Donkeys	25	15	10	10
Camels	2	1	11	2
Buffaloes	—	—	7	—
Dogs	7	1	—	12
Cats	—	2	—	3
Rabbits	3	—	—	—
	17,342	16,497	11,672	7,324

Meat Inspection.—14,577 animals were slaughtered at the Government Abattoir of which 10,609 were goats, 1,602 sheep, 1,594 oxen, 640 cows, 115 calves, 16 pigs and 1 buffalo. 412 animals were condemned before slaughter and 58 carcasses (32 cattle) after slaughter; 4,257 carcasses (1,222 cattle) were partially condemned. The total number of animals slaughtered is less by 1,042 than in 1933.

Mji Mpia Dairies.—The average number of animals housed at the Dairies was :—

Cows	503
Heifers and calves	217
Bulls	11

As noted above all cattle were inoculated against Pleuro-pneumonia, 21 cases of which occurred prior to inoculation. Apart from that and a few cases of contagious abortion, the health of the dairy herds was good and the animals were maintained in good condition. Weekly dipping is compulsory.

Veterinary Hospital.—526 cases were treated at the hospital.

A. J. FINDLAY,
Director of Agriculture.

TABLE I.

Protectorate Clove Crops for the Past 35 Seasons:—

Season.	Zanzibar. Fras.	Pemba. Fras.	Total. Fras.
1899/1900	64,000	221,000	285,000
1900/01	37,000	200,000	237,000
1901/02	44,000	333,000	377,000
1902/03	172,000	252,000	424,000
1903/04	27,000	99,000	126,000
1904/05	81,000	654,000	735,000
1905/06	178,435	129,735	308,170
1906/07	63,004	203,496	266,500
1907/08	213,662	541,993	755,655
1908/09	165,727	449,691	615,418
1909/10	109,678	300,047	409,725
1910/11	52,100	139,307	191,407
1911/12	216,507	582,153	798,660
1912/13	31,018	104,368	135,386
1913/14	145,586	638,094	783,680
1914/15	194,920	331,389	526,309
1915/16	141,641	655,116	796,757
1916/17	208,716	302,919	511,635
1917/18	63,958	234,239	298,197
1918/19	259,273	565,229	824,502
1919/20	93,847	168,703	262,550
1920/21	231,831	316,446	548,277
1921/22	65,819	200,983	266,802
1922/23	291,417	690,498	981,915
1923/24	75,027	236,767	311,794
1924/25	240,952	520,490	761,442
1925/26	219,192	392,622	611,814
1926/27	203,843	529,186	733,029
1927/28	190,370	500,382	690,752
1928/29	74,828	125,740	200,568
1929/30	318,647	610,296	928,943
1930/31	51,796	201,320	253,116
1931/32	175,070	760,786	935,856
1932/33	242,772	244,594	487,366
1933/34	136,984	789,332	926,316
Average 35 Seasons	145,189	377,855	523,044

TABLE II.

Monthly Average Price of Cloves and Stems—Local.

Month.	1933.				1934.			
	Zanzibar.	Pemba.	Stems.	Duty on Cloves.	Zanzibar.	Pemba.	Stems.	Duty on Cloves.
	Rs. per fras.	Rs. per fras.	Rs. per fras.	Rs. per fras.	Rs. per fras.	Rs. per fras.	Rs. per fras.	Rs. per fras.
January	9.54	8.34	1.75	2.75	8.34	7.75	1.40	2.00
February	9.94	8.98	1.81	2.75	8.18	7.65	1.46	2.00
March	9.28	8.70	1.81	2.75	8.05	7.79	1.44	2.00
April	9.14	8.53	1.83	2.75	7.81	7.59	1.49	2.00
May	8.90	8.32	1.70	2.75	8.61	7.86	1.34	2.00
June	10.32	9.82	1.80	2.75	9.57	9.07	1.44	2.00
July	8.60	8.20	1.77	2.00	9.65	8.79	1.37	2.00
August	7.96	7.46	1.76	2.00	10.40	9.37	1.36	2.00
September	8.12	7.50	1.78	2.00	9.92	9.63	1.26	2.00
October	7.77	7.32	1.64	2.00	9.27	9.26	1.37	2.00
November	7.89	7.08	1.66	2.00	8.87	8.93	1.38	2.00
December	7.43	6.92	1.70	2.00	8.87	8.78	1.20	2.00
Yearly Average	8.74	8.10	1.75	2.37	8.96	8.54	1.40	2.00

All the above prices are "duty paid". Prices for Stems are F.O.B.

TABLE III.

Exports of Cloves and Clove Stems.

Month.	1933.		1934.	
	Cloves. Frasilas.	Clove Stems. Frasilas.	Cloves. Frasilas.	Clove Stems. Frasilas.
January	58,678	9,213	76,135	24,847
February	43,603	13,162	62,286	21,312
March	54,618	16,320	56,808	40,442
April	53,126	13,040	46,422	31,501
May	32,638	12,299	73,796	12,318
June	19,142	4,661	51,719	12,403
July	1,00,784	19,742	60,259	32,844
August	64,868	15,514	84,645	10,965
September	63,555	15,237	1,18,386	11,565
October	66,948	19,633	12,008	17,544
November	67,863	15,192	22,627	4,968
December	63,216	17,527	30,954	11,684
Totals	6,89,039	1,71,540	6,96,045	2,32,393

TABLE IV.

Destinations of Clove and Clove Stem Exports.

	1933.		1934.	
	Cloves. Fras.	Stems. Fras.	Cloves. Fras.	Stems. Fras.
Great Britain and Northern Ireland ...	82,320	54,944	40,880	1,17,955
India ...	2,20,544	2,947	2,15,347	2,925
Straits Settlements ...	7,696	2,630	5,146	2,698
Canada ...	4,250	80	5,475	381
Union of South Africa ...	2,941	166	1,744	128
Tanganyika Territory ...	160	—	179	—
Kenya Colony ...	355	—	202	—
Australia ...	6,470	—	1,770	—
Aden ...	4,038	—	3,043	141
Ceylon ...	477	—	765	42
New Zealand ...	774	—	845	—
Cyprus ...	128	—	—	—
Dutch East Indies ...	2,23,185	17,181	2,84,435	19,360
United States of America ...	99,393	3	1,05,510	426
Mexico ...	390	—	237	—
Germany ...	6,947	89,987	6,205	78,771
Italy ...	3,990	202	2,854	—
Japan ...	4,090	915	752	1,113
Holland ...	3,219	2,400	4,432	8,032
China ...	1,037	74	1,072	—
Poland ...	102	—	—	—
Arabia ...	250	—	419	—
Turkey ...	64	—	26	—
Egypt ...	6,723	—	5,757	19
Brazil ...	1,142	—	800	—
Sweden ...	1,110	—	960	—
Syria ...	—	—	48	—
Mauritius ...	106	—	—	—
Denmark ...	499	—	1,741	—
Norway ...	202	—	198	—
Portuguese East Africa ...	67	—	42	—
Persia ...	387	—	—	—
Italian Somaliland ...	64	—	461	41
Greece ...	320	—	—	—
French Somaliland ...	704	10	509	—
Spain ...	1,501	—	944	—
Argentina ...	1,728	—	1,040	—
Malta ...	99	—	—	—
British Guiana ...	80	—	—	—
Belgium ...	506	—	61	—
Iraq ...	614	—	300	—
Danzig (Free State) ...	301	—	720	—
Portuguese India ...	67	—	—	—
Siam ...	—	—	566	362
Rumania ...	—	—	560	—
Total	6,89,040	1,71,539	6,96,045	2,32,394

TABLE V.

Monthly Average Price of Copra—Local.

Month.	1933.		1934.	
	per frasila. Rs. Cts.		per frasila. Rs. Cts.	
January ...	1	98	0	94
February ...	1	75	0	98
March ...	1	67	0	95
April ...	1	43	0	85
May ...	1	42	0	92
June ...	1	51	0	98
July ...	1	46	0	87
August ...	1	24	0	88
September ...	1	16	0	96
October ...	1	03	1	19
November ...	1	07	1	12
December ...	1	05	1	11
Yearly Average	1	40	0	98

TABLE VIA.

METEOROLOGICAL OBSERVATIONS, 1934.

Rainfall and Relative Humidity, Zanzibar.

Months	Salem		Kidichi		Machui		Mkokotoni		Chwaka		Tovu		Kizimbani		Dunga		Chukwani	
	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Average Relative Humidity %	Rain	Wet Days	Average Relative Humidity %	Rain	Wet Days
January	0.74	4	1.35	6	1.12	6	0.50	1	0.78	2	3.61	8	76	1.59	6	72	2.29	8
February	0.34	3	0.10	2	0.35	4	...	...	0.19	1	0.25	1	75	0.16	3	67	0.19	3
March	6.48	15	8.22	19	8.89	18	3.95	7	6.65	9	5.24	11	80	7.39	18	78	10.76	15
April	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
May	11.86	18	10.74	20	10.70	20	3.76	10	12.99	21	11.16	19	84	12.06	20	85	11.70	22
June	17.32	28	15.65	27	17.02	27	7.76	15	16.96	20	22.14	25	84	16.78	29	87	18.03	28
July	9.78	14	10.89	16	11.87	14	3.76	13	10.11	16	9.31	10	83	10.38	13	83	13.30	17
August	2.10	12	3.30	14	2.64	11	1.71	8	3.06	9	3.63	7	82	2.63	10	83	1.94	7
September	1.49	7	3.15	13	1.98	12	1.69	11	0.14	1	1.32	7	80	2.13	7	79	1.90	8
October	4.20	12	3.26	18	3.05	13	1.30	11	0.79	4	0.52	7	78	3.64	18	78	2.75	16
November	6.50	11	6.26	17	7.28	12	0.50	2	0.64	2	2.72	12	76	8.90	13	75	4.29	12
December	2.03	5	2.05	10	2.26	10	0.55	7	0.51	2	1.86	6	76	3.60	14	74	3.95	10
	5.53	15	7.55	16	5.59	11	1.83	8	5.44	9	15.87	14	79	7.17	18	79	6.50	17
Total 1934	68.37	144	72.52	178	72.75	158	27.31	93	58.26	96	77.83	127	79	77.03	169	78	77.60	167
Total 1933	52.83	127	55.99	115	61.37	137	17.01	47	40.00	78	47.54	100	79	55.21	145	79	50.07	150

Note:—Rainfall in Inches

TABLE VIb.

METEOROLOGICAL OBSERVATIONS, 1934.

Rainfall and Relative Humidity, Pemba.

Month	Wete		Mkomu		Membili		Kigomacha		Makondeni		Wesha			Fufuni		
	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Average Relative Humidity %	Rain	Wet Days	Average Relative Humidity %
January	0.70	2	0.52	4	1.81	6	0.57	1	1.92	3	1.04	3	71	0.79	3	76
February	...	...	0.10	2	0.23	2	...	...	0.11	1	...	...	68	...	...	76
March	4.72	11	9.07	12	9.29	17	3.33	6	7.78	15	7.82	14	74	9.02	13	77
April	10.25	17	13.07	14	12.34	21	3.65	10	13.49	23	10.51	16	81	12.05	16	86
May	25.60	24	25.37	25	29.76	31	23.30	23	28.89	30	33.64	30	87	24.51	26	89
June	13.00	18	21.47	18	23.07	24	11.96	20	15.75	22	15.26	26	81	21.59	19	84
July	3.05	7	3.19	11	4.01	18	6.77	15	5.68	22	2.97	14	75	3.34	12	81
August	0.95	4	0.51	5	0.17	9	2.18	9	1.59	10	0.37	7	70	0.32	4	75
September	0.65	3	0.41	6	0.62	12	2.25	8	1.76	10	0.41	9	69	0.71	6	76
October	2.40	3	1.06	6	1.05	9	8.69	12	2.13	8	2.90	5	69	0.48	4	73
November	1.50	4	1.72	6	6.36	12	2.06	4	3.08	8	1.96	7	71	3.17	8	72
December	4.64	9	6.22	7	13.87	21	3.75	8	7.30	11	6.50	16	79	10.95	15	79
Total 1934 ...	67.46	102	82.71	116	102.58	182	68.51	116	89.48	163	83.38	147	75	86.93	126	79
Total 1933	53.38	114	62.23	134	65.03	162	49.90	80	27.11*	72	50.58	128	79	58.16	113	78

Note:—Rainfall in Inches.

*Total From June to December, 1933.

TABLE VIc.
METEOROLOGICAL OBSERVATIONS, 1934.

Temperatures.

ZANZIBAR.										PEMBA.			
Town				Kizimbani		Dunga		Chukwani		Wesha		Fufuni	
	Mean Max.	Mean Min.		Mean Max.	Mean Min.	Mean Max.	Mean Min.	Mean Max.	Mean Min.	Mean Max.	Mean Min.	Mean Max.	Mean Min.
January	83.3	78.6	8.8	72.6	87.7	73.4	75.2	88.4	87.6	73.7	87.2	71.9	
February	87.3	80.6	90.4	73.3	90.9	74.9	76.0	90.8	91.0	74.6	89.3	72.1	
March	87.8	79.8	87.9	71.8	89.0	73.0	76.5	90.2	90.4	74.6	88.3	72.5	
April	85.5	77.5	85.9	72.6	87.5	72.4	76.6	86.1	86.2	74.0	84.8	74.0	
May	82.3	75.4	82.5	71.9	84.1	71.1	74.2	82.9	82.8	72.3	82.3	72.7	
June	81.6	74.6	81.3	70.5	83.3	69.0	73.4	81.6	80.8	70.7	80.6	71.7	
July	80.8	73.3	81.2	68.7	83.4	67.2	72.0	80.9	81.1	69.6	80.3	71.5	
August	82.1	73.4	82.2	67.2	83.6	64.8	71.4	80.7	82.4	69.4	81.2	72.4	
September	82.3	73.8	81.8	67.3	83.0	64.3	71.6	82.1	84.5	69.9	82.2	71.8	
October	83.3	75.7	83.6	68.5	83.5	65.9	72.6	84.9	86.7	71.0	85.5	70.3	
November	86.1	79.2	87.0	71.7	84.7	69.6	74.4	90.1	88.9	73.0	87.4	71.1	
December	85.9	79.3	87.4	73.1	85.7	72.2	75.9	87.8	88.6	73.8	87.7	72.6	
For the Year ...	84.3	70.8	84.9	70.8	85.5	69.8	74.2	85.5	85.9	72.2	84.7	72.1	

Note:—Temperatures in Degrees Fahrenheit.

